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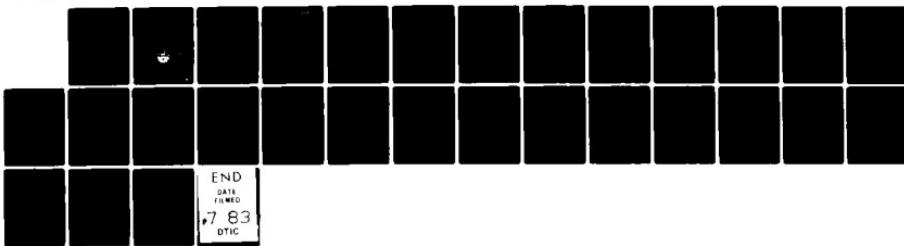
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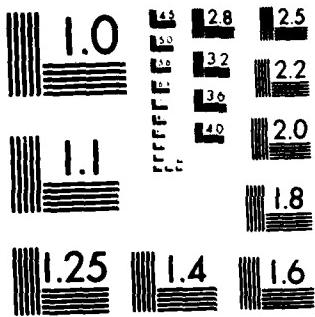
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NAVY PERSONNEL ACCESSIONING SYSTEM (NPAS): II. SUMMARY OF RESEARCH AND DEVELOPMENT EFFORTS AND PRODUCTS

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides a summary of the research and development (R&D) efforts completed on the Navy Personnel Accessioning System (NPAS) project and listings of R&D products resulting from that project. NPRDC Special Reports 83-34 and 83-36 respectively describe the conceptualization and design of NPAS and the development of a microcomputer-based demonstration system.

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FOREWORD

This research and development (R&D) project was conducted within exploratory development task area 64709N (Prototype Manpower/Personnel System) and was sponsored by the Chief of Naval Operations (OP-01). The purpose was to design, develop, test, and evaluate a distributed processing Navy personnel accessioning network. Computer-based personnel assessment and measurement techniques were integrated into a system designed to (1) serve as a data base management and labor-saving device for the Navy Recruiting Command (NRC), (2) assign recruits optimally to Navy jobs and reserve training school seats, (3) provide individualized career information with fewer support personnel than at present, and (4) ensure improved person-job placement. The resulting Navy Personnel Accessioning System (NPAS) (Z-1039PN) was expected to benefit the NRC and the Naval Military Personnel Command. However, Navy support for R&D efforts on NPAS was terminated on 30 September 1981 as a consequence of large program element fund reductions.

This is the second of three reports that document the NPAS project for Navy managers and the R&D community. The other reports provide a background and overview of the NPAS project and a description of a microcomputer-based demonstration system (NPRDC SRs 83-34 and 83-36).

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SUMMARY

Problem and Background

The combined effect of a shrinking pool of eligible personnel and an increasing need for high quality accessions makes the Navy's recruitment and optimal use of personnel a critical need throughout the ensuing decade. Present accessioning methods are inadequate for screening and assignment, place clerical burdens on the recruiter, and provide limited vocational guidance. Attrition and marginal performance are abetted by cumbersome and inefficient accessioning procedures. The increasing capability and decreasing cost of computer equipment have broadened computer applications to personnel management. However, the proliferation of computer systems increases the danger that inadequate and incompatible systems will be procured. In the fiercely competitive recruitment arena likely to occur soon and to persist for several years, the edge will accrue to the armed service that applies computer technology to the problems of recruiting.

The purpose of the Navy Personnel Accessioning System (NPAS) project was to develop, test, and evaluate a distributed processing, Navy personnel accessioning network. Computer-based personnel assessment and measurement techniques were to be integrated into a system designed to (1) serve as a data base management and labor-saving device for the Navy Recruiting Command, (2) assign recruits optimally to Navy ratings and reserve training school seats, (3) provide individualized career information to applicants with fewer support personnel than at present, and (4) improve person-job placement. However, because of funding reductions, the NPAS project was terminated in September 1981.

Purpose

The purpose of this report was to summarize the research and development (R&D) efforts performed under the NPAS project and to provide listings of the resultant R&D products.

Results

1. R&D efforts conducted under the eight steps included in the general approach to the project were summarized.

2. An annotated listing of R&D products by topic area and a listing by type of product were developed. These listings are provided in the appendix.

Recommendations

Recommendations were developed under the following topic areas:

1. System conceptualization and design.
2. Person-job matching (PJM) functions.
3. Recruiting management support (RMS) functions.

CONTENTS

INTRODUCTION

Problem and Background

The combined effect of a shrinking pool of eligible personnel and an increasing need for high quality accessions makes the Navy's recruitment and optimal use of personnel a critical need throughout the ensuing decade. Present accessioning methods are inadequate for screening and assignment, place clerical burdens on the recruiter, and provide limited vocational guidance. Attrition and marginal performance are abetted by cumbersome and inefficient accessioning procedures. The increasing capability and decreasing cost of computer equipment have broadened computer applications to personnel management. However, the proliferation of computer systems increases the danger that inadequate and incompatible systems will be procured. If the Navy is to compete in the fiercely competitive recruitment arena likely to occur in the near future and to persist for several years, it must effectively apply computer technology to the problems of recruiting.

The Navy Personnel Accessioning System (NPAS) was a multiyear project conducted by the Navy Personnel Research and Development Center (NAVPERSRANDCEN) to produce a comprehensive, state-of-the-art, computerized personnel accessioning system for use by Navy recruiters at recruiting stations. Its purpose was to develop, test, and evaluate a distributed processing, Navy personnel accessioning network. Computer-based personnel assessment and measurement techniques were to be integrated into a system designed to (1) serve as a data base management and labor-saving device for the Navy Recruiting Command (NRC), (2) assign recruits optimally to Navy ratings and reserve training school seats, (3) provide individualized career information to applicants with fewer support personnel than at present, and (4) improve person-job placement.

Early in system development, it was determined that NPAS would include two types of functions: (1) those dedicated to person-job matching (PJM) and (2) those dedicated to recruiting management support (RMS). The former would offer enhanced screening with adaptive testing, vocational guidance, and assignment prediction; the latter was designed to ease the recruiter's burden of data entry, storage, and retrieval and to improve the quality of reports and forms. Baker (1983b) describes the initial steps in the project. However, due to funding reductions, efforts on the NPAS project were terminated in September 1981.

Purpose

The purpose of this report was to summarize the research and development (R&D) efforts performed under the NPAS project and to provide listings of the R&D products resulting from the project.

RESULTS

R&D Efforts Conducted Under the NPAS Project

The eight steps to be included in the approach to the NPAS project are listed below and described in the following paragraphs:

1. Conduct needs assessment studies for the PJM and RMS functions.
2. Develop the functions to be supported by the system.
3. Compile data bases of entry-level Navy ratings and related civilian occupations.

4. Develop interactive dialogues to facilitate user-system interface.
5. Develop the software to support the various functions.
6. Conduct a field test of the NPAS demonstration system.
7. Demonstrate NPAS to Commander, Navy Recruiting Command (CNRC).
8. Manage the NPAS project in conjunction with appropriate Navy offices.

Conduct Needs Assessment Studies

Two needs assessment studies were conducted. The purpose of the first was to examine and document the procedures followed in the three PJM functional areas: applicant screening with adaptive testing, vocational guidance, and assignment prediction (Baker, 1983a). The purpose of the second was to determine which RMS requirements (data collection, transmission, and reporting) could be automated by NPAS. This latter study encompassed all data and reports needed to process Navy accessions, as well as the administrative data and reports needed to manage recruiting goals, budgets, resources, and productivity (Giese & Wyrick, 1981).

Develop Functions

PJM functions.

1. **Applicant screening with adaptive testing.** An adaptive screening test with item banks was developed to increase the effectiveness of personnel screening. Individual items were calibrated using available Marine Corps data to produce the parameters for selection of specific items. An item-selection algorithm was developed that determined both the individual items and the item presentation sequence for each applicant.

2. **Vocational guidance.** This function was developed based on a review of the literature, the findings of the PJM needs assessment study, and flow charts showing the presentation sequence of information to applicants. The resulting computer-based vocational guidance system provided several advantages over the present system: scoring is more accurate, presentation is more consistent, the information is more current, and results are obtained more quickly. In addition, applicants are able to go through the guidance process at their own pace without constant recruiter intervention.

3. **Assignment prediction.** A major effort of the NPAS project was to construct a personnel assignment prediction model (preassignment) that could be used at Navy recruiting stations (NRSs) to forecast rating alternatives available to the applicant during a subsequent military entrance processing station (MEPS) classification interview. Thus, the computer-based system could focus the applicant's attention on ratings that are likely to be open and offered as choices.

RMS functions. The specific data base management requirements to be addressed under the NPAS project were identified by the RMS needs assessment study. The RMS function was composed of three components: (1) data entry, storage, and retrieval, (2) forms generation, and (3) reports generation.

Compile Data Bases

Two large data bases were completed for the PJM vocational guidance function: one describing all of the entry-level Navy ratings, and the other describing 100 civilian occupations or occupational clusters.

Develop Interactive Dialogues

Four interactive dialogues were developed: three to handle the interactions between the applicant and each of the three PJM functional areas (applicant screening with adaptive testing, vocational guidance, and assignment prediction) and one for the RMS function to handle the interactions between the recruiter and the computer system. Those for the PJM function were developed for the average applicant, who was assumed to have no experience with a computer or even a typewriter.

Develop Software

An extensive computer software development effort was required to support the delivery of the recruiter-oriented RMS function and the applicant-oriented PJM function. This software was written to perform the following functions: (1) control the presentation sequence of the extensive interactive dialogues, including numerous branching possibilities, (2) administer, score, and provide on-line interpretation of the aptitude test and an interest inventory, (3) provide career planning information and an interpretation of Armed Services Vocational Aptitude Battery (ASVAB) scores, (4) control access to and presentation of information contained in the Navy ratings and civilian occupations data bases, and (5) summarize the vast amount of information presented to each applicant. With this software, applicants were able to evaluate the system on-line to improve the applicant-oriented PMS functions.

Plans were to develop a minor part of the software on the UNIVAC 1110 system at the Naval Ocean Systems Center; and the majority of the software, on a commercial, nationwide, time-sharing system. Computer time was to have been obtained through a teleprocessing services program. However, because the time alloted for development was shortened and funding terminated, software for a microcomputer-based system was developed on available microcomputers at NAVPERSRANDCEN.

Conduct Field Test of the NPAS Demonstration System

Plans were to (1) test the NPAS demonstration system at NAVPERSRANDCEN, (2) implement it on a time-sharing system with leased peripheral equipment and software developed under the NPAS project, (3) install it at three NRSs in a phased schedule over a 6-month period, and (4) conduct a field test. The test was to serve the following purposes:

1. Document frequency of usage and user acceptance.

2. Record types of transactions and user satisfaction with computer response times and system availability.

3. Identify the need for instructional materials for video display terminal operators.

4. Assess logistics and maintenance support in an operational environment.

5. Identify personnel savings and processing efficiencies that could be achieved through automation.

6. Establish interrelationships and optimal sequencing of functions.

7. Determine the elapsed time between computer displays and user responses.

8. Determine the quality and quantity of data input to data bases.

Results of the field test would have been evaluated from the perspectives of both recruiters and applicants by (1) conducting extensive structured interviews with the recruiters using the system, (2) having applicants evaluate each module on-line as it was completed, and (3) developing a monitor log to gather data throughout all system interactions. However, although the field test was not conducted, a microcomputer-based demonstration system was shown at a recruiting station. System specifications, a functional description, a task management plan, and a performance evaluation review technique (PERT) chart for this demonstration system were developed under contract.

Demonstrate NPAS

Once the intention to terminate funding became known, all efforts turned toward developing a modified demonstration system to present to CNRC at a decision briefing. This demonstration system, which was a truncated version of the planned demonstration system for the proposed field test, is described in detail by Baker, Rafacz, and Sands (1983).

Manage NPAS Project

Giese and Wyrick (1980) studied the relationship of the NPAS project to various offices within the Navy (e.g., NRC, Navy Data Automation Command, and OP-16) so that a comprehensive implementation planning document responsive to directives governing major system acquisitions could be developed. This document would not only ensure compliance with existing directives, but also serve to (1) demonstrate that NPAS functions could be performed in NRC's operational environment, (2) identify functions that could be accelerated and implemented, (3) identify alternative decisions in system capability, cost, scheduling, and work, and (4) document findings. However, due to a reduced time schedule, only preliminary work was accomplished toward drafting this planning document (Giese & Wyrick, 1980).

R&D Products

An annotated listing of R&D products by topic areas and a listing by type of product are provided in the appendix.

RECOMMENDATIONS

System Conceptualization and Design

1. A cost study of alternative network configurations for automating Navy accessioning should be performed.

2. The feasibility and desirability of incorporating a videodisc capability into NPAS should be studied.

3. The NPAS demonstration system should be field tested at selected Navy recruiting stations.

4. All interactive dialogues should be tested using Navy recruits and recruiters.

5. The desirability of using additional screening instruments within NPAS should be investigated.

6. A model NPAS training program for recruiters should be developed.

7. Parallel system testing should be conducted in a large recruiting office.

Person-Job Matching Functions

Applicant Screening With Adaptive Testing

1. The Computerized Adaptive Screening Test (CAST) used in applicant screening (Baker, 1983b) should be field tested to determine its effect on recruiting and quality control and compared to the enlistment screening test.

2. The feasibility of using additional adaptive tests within NPAS should be investigated.

3. CAST items should be calibrated on a Navy population.

Vocational Guidance

1. The automated guidance for enlisted Navy applicants system should be field tested.

2. The need for an interest inventory specific to military service and the Navy should be investigated for incorporation into the career planning and PJM functions.

3. The need for a values-clarification module in the PJM vocational guidance function should be investigated.

4. The complete form of the vocational guidance modules should be field tested to determine their effect on recruiting operations.

Assignment Prediction

1. The pre-CLASP process should be field tested at recruiting stations to determine acceptability and effect on recruiting operations.

2. The effect of pre-CLASP on managing the delayed entry program should be investigated.

3. A cost study of placing "A" school reservations at NRSs should be performed.

Recruiting Management Support Functions

1. A cost study of automating enlistment forms should be conducted.

2. The effect of more immediate access to recruiting station data on recruiting management should be investigated.

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APPENDIX

LISTINGS OF NPAS R&D PRODUCTS

ANNOTATED LISTING BY TOPIC AREA

System Conceptualization and Design

Functions Required of an Automated Accessing System

1. The computer as a tool in counseling and testing (Korotkin & Marshall-Mies, 1980). The state of the art in computer-aided counseling and testing was assessed. A literature review resulted in a tentative conceptual framework for a computerized counseling system for use in Navy recruiting. The technology necessary to support this system was identified.

2. The Navy Personnel Accessioning System needs assessment for personnel management support (Giese & Wyrick, 1981). This study analyzed the flow of information throughout the various levels of NRC. Data were collected using a structured interview approach. The Navy Recruiting District Standard Operating Procedures Manual (1976) was used to direct the data collection effort to the proper offices, billets, and tasks. The focus was on identifying the source documents and management reports used in resource planning and allocation, administration, marketing, recruiting, applicant flow, quality control, and evaluation. Data were collected from (a) the standards and audit team, (b) Headquarters, NRC, (c) a representative sample of area and district headquarters, (d) associated recruiting stations, and (e) MEPS. The source documents and reports identified were considered for automation if such automation had the potential to reduce: (a) the time required to transcribe, edit, summarize, process, transmit, receive, and use the material, (b) errors, (c) administrative processing delays caused by lost or incomplete forms and reports and transmittal time, and (d) costs for personnel, communications, and supplies, or to improve (a) control over applicant flow (tracking), subordinates, and information, (b) flexibility through efficient information storage and retrieval, and (c) ability to handle a wide variety of reporting requirements and to implement Navy management policies.

After Giese and Wyrick had examined the existing accessioning methods and procedures, they estimated the volumes of data and activities required for major support areas, described primary and secondary candidates for automation, and recommended specific future actions in developing a demonstration system, including monitoring related automated systems in Navy recruiting districts (NRDs) and chartering a steering committee to guide NPAS R&D within the context of Navy recruiting policy.

3. A person-job matching system for Navy recruiting: Background and needs assessment (Baker, 1983a). A study was conducted to examine the three functional areas of person-job matching (PJM): applicant screening with adaptive testing, vocational guidance, and personnel assignment prediction. A literature review was included in this study. Data were collected using a questionnaire and a structured interview approach. The recruit experience questionnaire (REQ) was developed and administered to Navy recruits at the recruit training centers (RTCs) at Great Lakes, Illinois and Orlando, Florida. The recruit structured interview, administered to 20 recruits at each site, served as an in-depth probe in support of the REQ. Additional interviews were conducted with Navy recruiters and recruiting management personnel at NRD San Diego.

The current procedures used for applicant screening, vocational guidance, and personnel assignment were documented. Problems with existing procedures and the needs in each area that could be addressed by NPAS R&D efforts were identified.

Accumulated study data showed that the Navy depended on nonprior-service youths, 18 to 22 years of age, for most of its recruits. Members of this group are unsure of themselves concerning life directions, have received little or no vocational counseling, are vocationally immature, and know almost nothing of job opportunities relevant to their aptitudes and interests. Navy recruiters do not have the expertise or training to conduct in-depth, meaningful vocational guidance. Current recruiting practices provide little or no vocational guidance, which may be a contributing factor to in-service job dissatisfaction and attrition.

4. Interviews with Navy recruiting command management personnel. Interviews were conducted with NRC managers at HQ, NRC, and NRDs throughout the project to (a) determine general management support for an automated accessioning system, (b) gauge management acceptance of vocational guidance, particularly at the Navy recruiting station (NRS) level, (c) solicit suggestions for additional capabilities, (d) identify problems in the recruiting arena that could be addressed by NPAS, and (e) delineate specific management-perceived needs. While managers generally supported research efforts and offered suggestions for automating recruiting, most of their favorable attention was focused on the management support capabilities. Under current policy, discussion of specific ratings at the recruiting station level is prohibited. In addition, the vocational guidance provided by the classifier at MEPS is designed to enlist applicants into the Navy rather than assist them in making an informed choice. Most of the interviews indicated that the prognosis for immediate Navy employment of a comprehensive, state-of-the-art, automated accessioning system is poor.

5. Field recruiter interviews assessing needs and acceptance. Structured and unstructured interviews were conducted at frequent intervals with field recruiters and HQ, NRD, San Diego recruiting personnel to (a) determine recruiter-perceived system needs, (b) solicit suggested system design and improvements, (c) gauge potential acceptance and utilization, (d) determine readability levels of software dialogues, (e) assess post-implementation training requirements, and (f) observe the recruiting process. Results were similar to those of the interviews with Navy recruiting managers. Recruiters are open and helpful in suggesting design improvements, explaining the recruiting process and voicing perceived needs. Many recruiters offer what vocational guidance they can (e.g., providing Navy rating occupational information, despite policy proscriptions). In this small sample, readability of the dialogues was found to be appropriate. Training requirements were estimated for immediate post-deployment and subsequent periods.

6. Automated Guidance for Enlisted Navy Applicants (AGENA) system (journal article) (Sands, 1980). This research focused on the modular conceptualization of an automated enlisted accessioning system to incorporate screening, guidance, and assignment prediction capabilities applicable at the NRS level on a microcomputer system. This system conceptualization, which became the central portion of NPAS, was designed to be easily used by a novice and was menu-driven with complete interactive dialogues (Baker, Rafacz, & Sands, 1983).

Configuration of Computer Hardware

1. Selection of an occupation counseling computer network system for the Navy recruiting environment (working paper) (Rafacz, 1978a). This research, which addressed PJM and management support functions, established that a distributed processing network is most appropriate for implementation in the Navy's recruiting environment. Components of the distributed network were identified for recruiting areas, districts, and stations. In this research effort, a mobile van was used to take a computer's processing

power to field recruiting sites (e.g., shopping centers, high schools, fairs). A prototype computer system was identified and related to ongoing NAVPERSRANDCEN research efforts that were investigating the feasibility of automating the recruiting functions on a distributed processing network.

2. Feasibility study of a distributed network for Navy recruiting (working paper) (Rafacz & Underwood, 1978). A number of distributed networks were examined that offered potential for performing several functions of Navy recruiting. The focus was on wide capabilities within the recruiting station itself, often referred to as front-end recruiting, that could simplify the entire recruiting process. It was concluded that, although such a system was indeed feasible, policy changes would be required to permit its implementation. A fully automated computerized counseling, testing, assignment/reservation, and recruiting management support network of minicomputers was designed to be capable of annually processing 800,000 recruit applicant transactions at Navy recruiting stations and more than 1,000,000 sessions at high schools in the continental United States. The objective of the research was to develop cost estimates of the network over various implementation phases. Evaluation criteria were developed that were seen as relevant to the applications and within the capabilities of the available computer technology. General guidelines used to develop the evaluation criteria were (a) capability of generalized software, (b) fourth-generation hardware for the selected network, (c) minimization of telecommunications costs, (d) operator convenience and ease of use, and (e) minimization of software development costs (i.e., availability of "off-the-shelf" software). Finally, the following relevant evaluation criteria were identified: job mix control, operating system features, data base management system considerations, data communications, and provision for a processing load spillway when an information overload occurs on the system.

The actual network design for the anticipated recruiting functions was isolated by applying the evaluation criteria to a set of two candidate networks--centralized and distributed. The result of this analysis (considering such issues as reliability, telecommunications, user access to data, resource management, and network control) was that a distributed network was the most appropriate for implementing the recruiting functions. Components for a candidate distributed network were identified. The network involved the placement of a multiprocessor unit at the Great Lakes Naval Base, minicomputers at each of the Navy area and district HQ, and terminals at recruiting stations. Mobile van units, including a minicomputer and terminals, were planned to provide recruiting services more directly to potential applicants at high schools, community colleges, and other field sites. The distributed network that was proposed would be capable of storing at least 7,000,000,000 bytes of data on disk. The main central processing unit (CPU) memory would approach 6,000,000 bytes over 112 processors with a maximum terminal handling capacity of about 5,500 (pollable) devices. In particular, detailed network components were outlined for all districts within area seven of NRC.

Several network development phases were proposed: (a) the prototype development phase in which the software for the recruiting functions was to be optimized for the class of proposed hardware, (b) the mininetwork development phase in which current reservation and assignment functions were to be implemented by placing minicomputers at each recruiting area office for management support functions and selected functions for district offices, and (c) the large-scale network development phase for the full complement of recruiting functions and proposed hardware for the selected distributed networks. Fixed and recurring costs of the network components were estimated for the large-scale network. In addition, such issues as software procurement, maintenance, installation, training and retraining, and R&D costs were also estimated and described.

To support the need for ongoing R&D network design, engineering development plans were discussed from the standpoint of mobile and fixed station software development, processing load spillway, programmable switching equipment, multivendor interfacing software, and bit-efficient storage techniques. Finally, a cost-benefit analysis was developed covering (a) recruiting management savings, (b) release of recruiting stations, (c) replacement of current recruiting automated functions, (d) release of telephone lines, and (e) decreased personnel attrition.

3. A distributed computer network for Navy recruiting (working paper) (Rafacz & Underwood, 1979). The objective of this research was to investigate the feasibility of using several distributed processing networks to perform Navy recruiting functions. Those functions of concern to this research were data-base management, preenlistment testing, vocational information on Navy ratings and career fields, and optimal sequential assignment. It was concluded that (a) centralized computer system was not optimal for supporting the function within the NRC, (b) a distributed system could accomplish these tasks far more efficiently and at much less cost, (c) data-base management functions were easily simplified and improved by such a network, (d) preenlistment computerized testing would result in fiscal and temporal savings as well as better prediction of armed forces qualification test (AFQT) scores; and (e) Navy vocational information could be uniformly presented in an unbiased, comprehensive fashion.

4. Occupational career counseling: Mobile van design specifications (working paper) (Rafacz, 1978b). This exploratory research was the starting point for the eventual detailed design specifications necessary to realize a completely mobile occupational career counseling, testing, and classification system for use in career counseling in Navy recruiting. This research could have particular relevance to a recruiting adjunct to the high school testing program. The report included complete mobile van specifications, including electrical power requirements for minicomputers and terminals installed in the van.

5. Hardware proposal for an automated military career information system (working paper) (Rafacz, 1981). This research described the functional specifications of the proposed hardware to be used in the Department of Defense (DoD) military career information system (CIS). This effort drew on NPAS researchers' experience in hardware and software development in the areas of minicomputer- and microcomputer-based stand-alone systems that address research, operational, and personnel processing problems. Functional specifications were identified and related to a set of candidate computer networks. Completely centralized, decentralized, microprocessor-based, and completely distributed networks and a mobile minicomputer system were evaluated. A network selection analysis was conducted and a microprocessor-based network was identified as the most appropriate (given the selection factors) network for implementation in a military CIS. System components, their purchase costs, and recurring costs were described. It was recommended that a demonstration hardware system for a typical CIS be procured and that the feasibility of deploying such a network be studied further.

6. NPAS configuration alternatives: Preliminary results (working paper) (Kresin & Giese, 1981). Generic information system configurations capable of satisfying the NPAS requirements and workload were determined. Authors studied the proposed NPAS workload, examined analytic modeling tools for possible use in evaluating alternative configurations, and developed several generic configurations. The workload, tools, and configuration alternatives were described, as well as the ways each alternative configuration might perform various NPAS functions. Because the research was truncated by funding considerations, only preliminary results were provided.

Research Support Hardware Needed to Develop Required Functions and Software

1. Benchmark performance results--Prime Computer Corporation Inc. (unpublished report) (Rafacz, Rahilly, & Buckingham, 1980a). Prime Computer Corporation's systems 550 and 750 were tested relative to a benchmark procedure (i.e., criteria for evaluating the system) that reflected the intended use of the computer system to be procured. Testing documentation included an innovative performance measurement criteria and evaluation techniques over a wide range of typical recruiting activities. The evaluation committee identified seven workload scenarios as being most appropriate to meet the demanding workloads of both a research minicomputer system and a minicomputer that must serve as a prototype for NRD implementation in NRD offices: priority change trial, run-time error contingency handling, concurrent processing trial with remote job entry (RJE) work station, input and output trial, concurrent batch and interactive trial, CPU and virtual trial, and reentrancy trial. All trials were conducted at the vendor's site over a 2-day period. Performance evaluation criteria for evaluating the system under test (SUT) were a combination of experienced minicomputer performance measures and best estimates of minimum performance requirements for the Navy recruiting environment. In addition, relative cost per CPU memory unit was used as a basis for comparing the systems being evaluated.

2. Benchmark performance results--Harris Corporation (unpublished report) (Rafacz, Rahilly, & Buckingham, 1980b). The Harris Corporation's 500 and 800 computer systems were subjected to the benchmark process to assess their performance relative to the intended applications of a proposed procurement computer system. The evaluation procedure and factors were identical to those used to evaluate the Prime Computer Corporation's 550 and 750 systems.

3. Hardware/Software remote terminal emulator system configuration (unpublished report) (Rafacz & Buckingham, 1980). This report described a computer hardware configuration designed and procured by NAVPERSRANDCEN to function as a remote terminal emulator (RTE) device and listed the software to be developed for the system as a separate task. The hardware configuration consisted of a PDP 11/34 minicomputer (256K bytes main memory), a Control Data 9766 300MB removable disk (with controller), 512K bytes mass memory device, an eight Channel MUX, two Plessey Corporation high-speed microprocessors, two DMA channels, and an operator's console. The system software available for the developmental effort included DEC's RSX-11M operating system, DEC's BASIC Plus 2 compiler, a Pascal compiler, and a complete set of Plessey system support software (PL/MIPROC computer, MIPROC X-assembler, and an MLINK routine). The hardware and software were procured by NAVPERSRANDCEN to further develop a collection of software packages that would permit the entire collection to act as an RTE. The report further describes the software tasks required of the RTE effort in both a developmental and an operational mode. In addition, the software development packages were described in terms of specifications and a structured design--the result of a prior contract effort.

4. MIPROC-based terminal emulator (Data/Ware Development, Inc., 1980). A data description and definition list, structured block diagrams, structured design, system user's manual, and complete software specifications for the NAVPERSRANDCEN RTE were developed.

5. Remote terminal emulator software development tasks (working paper) (Rafacz, 1980b). This work documents the software development tasks required for development of an RTE system for the NPAS project. The research was conducted to provide the basis for a preproposal conference briefing. The effort gave a general overview of the concept

of an RTE, describing the primary hardware components. Essentially, five software development tasks were identified: (a) software development, (b) software documentation, (c) software evaluation plan, (d) RTE demonstration, and (e) RTE user's manual. Each of these tasks were detailed related to the actual software development required. The actual terminal emulation process subsumed three phases: (a) preemulation, (b) the actual emulation process, and (c) postemulation. A software package, the script compiler, would have been developed during preemulation to process and translate script messages (sequences of user system commands) provided the RTE system by a user. During the actual emulation process, two software packages would come into play: a controller program and an emulator program. The controller program would reside on a PDP 11/34 computer and oversee the emulation (i.e., it would assign script messages to the appropriate terminal, using the compiler script files). The emulation program would reside in a high-speed microprocessor and interact with a system under test (SUT). It would accept script data from the controller and pass the data to the proper port on the computer under test. In addition, it would build a log file of emulation events. The log-editor program (postemulation) was the final required software. This program would translate logged data received from the run-time emulation program into a more readable form. In addition, a presentation was developed on the RTE hardware, including detailed information on specific hardware components of the RTE system and their relationship to the software development tasks.

6. Remote terminal emulator software development (Rafacz, 1980c). This work summarizes the coding and system testing requirements for four software packages that permit the RTE hardware and software to function as an RTE (i.e., a system that would impose upon a computer SUT a workload closely resembling human operators working at 64 interactive remote terminals).

Person-Job Matching Functions

Applicant Screening with Adaptive Testing

1. Computerized Adaptive Screening Test (CAST) item bank development (University of Minnesota, 1981). Complete item banks and item parameters were produced under this contract for the three subtests of the Computerized Adaptive Screening Test (CAST): Word Knowledge (WK), Arithmetic Reasoning (AR), and Paragraph Comprehension (PC). Item parameter estimates and items were delivered for 78 WK items, 247 AR items, and 25 PC items, using a data comm line from the HP-21 MX computer at the University of Minnesota to an Applied Computer Systems microprocessor at NAVPERSRANDCEN. Each test item was identified in the item bank by three parameters: discrimination, difficulty, and guessing.

2. CAST administration screen dialogue development. Screen dialogues were developed for interactive, automated administration of the CAST. The reading level was evaluated to ensure it was appropriate for the educational level of Navy enlisted applicants. Dialogues were tailored to the administration of the CAST at the recruiting station level on a stand-alone microcomputer system.

3. CAST processing at NAVPERSRANDCEN (Rafacz, 1982). Complete software packages were developed to permit interactive administration of CAST on a micro-computer. The necessary algorithms and computational procedures were incorporated to enable the test to be adaptively administered and scored. Estimates of the candidate's ability level on three subtests and a prediction of the applicant's subsequent AFQT score were generated. Two computer programs were developed to convert the item banks received under contract into an acceptable format for the CAST process. Subsequently, a

computer program was developed for administering CAST that incorporates the screen presentation dialogues and the algorithms governing item selection and score computations.

Vocational Guidance

1. The development of a counseling data base and dialogues for incorporation into an automatic guidance system (Korotkin, Leadley, & Marshall-Mies, 1980). This contract effort resulted in the following:

a. A Navy ratings data base that described 91 entry-level Navy ratings, including information on general description, related civilian jobs, "what they do," qualifications, working conditions, sea/shore rotation patterns, training provided by the Navy, and Navy opportunities. This data base was delivered in card image on a 9-inch reel, 9-track magnetic tape (1600 bpi). The tape was left unblocked, due to varying lengths of the descriptions, and a coding system was developed to facilitate data extraction by programmers. Two forms of the data base were delivered: (1) a long form, containing all categories of information mentioned above, and (2) a short form, omitting "what they do," sea/shore rotation, and training provided by the Navy.

b. A civilian occupations data base that described 100 civilian occupations and occupational clusters, related and cross-referenced to the entry-level Navy ratings. The data base included information on general description, qualifications and training, pay and working conditions, employment outlook, and related Navy jobs. The data base was in the same format as the Navy ratings data base.

c. A set of system flow charts that described how each major element of the guidance system interacts with the user. These flow charts described the sequence of the guidance session, and the type, quantity, and format of the information provided to the applicant.

d. A set of printed dialogues (derived from each of the system flow charts) that provided a set of video display frames with information to the user that allowed interaction between the user and the system.

2. Navy ratings data base review, editing, and revision. NAVPERSRANDCEN researchers assessed and revised the Navy ratings data base for readability and content. The Navy ratings data base reflected the latest official information on ratings.

3. Civilian occupations data base review, editing, and revision. The civilian occupations data base was reviewed by NAVPERSRANDCEN researchers for reading level, accuracy, and comparability to Navy ratings. Minor changes were made where necessary.

4. Vocational guidance interactive screen dialogue revision. Screen dialogues were closely scrutinized for content, reading level, ease of use (often referred to as user-friendliness), and professional tenor. Major revisions of screen dialogues were made by NAVPERSRANDCEN researchers to accommodate language and reading level of the target audience. The result was an interactive, computerized career guidance system applicable to Navy recruiting stations.

Assignment Prediction

1. __Development of the pre-CLASP procedure.__ A procedure was developed that predicted the CLASP (Kroeker & Rafacz, 1982) assignment options prior to the applicant's visit to a MEPS. That is, with the addition of two data elements, preferred ship month and MEPS arrival date, pre-CLASP predicted the actual ratings that would be offered to the applicants at their MEPS classification interview. This technique permits much of the classification process to occur at a recruiting station, where career guidance is most appropriate. This process would be consistent with the actual assignment still occurring at MEPS where CLASP is operating under the PRIDE system.

2. __Evaluation of the pre-CLASP procedure (Rafacz & Betts, 1980a).__ The pre-CLASP procedure was subjected to a test against the actual Navy entry-level assignments that were produced by the parent CLASP procedure. This work produced the following results: Optimality indicators produced by the pre-CLASP process (executed at the recruiting station) were not significantly different from the CLASP optimality indicators (generated when the applicant was at the MEPS) and almost no errors were made in predicting future availability of a Navy rating at the MEPS site when the recruiting station accession file was updated at least once a week. These results were independent of an applicant's position for enlistment in the recruiting time frame. These results suggest that it is now possible to effect the reservation and/or assignment of many applicants at a Navy recruiting station, prior to their visit to a MEPS. This would minimize the need for the Navy's current PRIDE system and its associated operating costs. The pre-CLASP procedure would be implemented using a microcomputer at a recruiting station, requiring very little communications. Telecommunications costs for NRC would be reduced significantly.

3. __Pre-CLASP field demonstration documentation (Rafacz, 1980a).__ The purpose of this document was to provide information on the pre-CLASP assignment process to the NAVPERSRANDCEN contractor. The pre-CLASP process was described to include detailed information concerning the data files required during the NPAS field demonstration. Special emphasis was placed on a recommended procedure for the weekly transfer of accession-related data from the Navy's PRIDE training school seat reservation system to the NPAS demonstration computer.

There were two main areas of concern in the document: pre-CLASP functional requirements and pre-CLASP data requirements. The issues that were addressed relative to functional requirements were: (a) background (e.g., source of request for pre-CLASP, significant correspondence, and technical documentation), (b) system summary (e.g., use and purpose of pre-CLASP, performance requirements and goals, current operating methods, procedures and deficiencies, data flow requirements, benefits, organizational impact, assumptions and/or constraints), (c) system characteristics (e.g., specific performance requirements and data file updating requirements), and (d) environment (e.g., hardware and software requirements, interface requirements, security, and privacy needs). The data requirements issues centered on such concerns as: (a) general information (e.g., project references, classified data needs, and acronyms employed), (b) data description (e.g., list of titles and data elements and dynamic data to be updated regularly), and (c) data collection (e.g., types of information and data values, hard copy output needs, and special instructions for data collection).

4. __Pre-CLASP field demonstration and software documentation (Rafacz & Betts, 1980b).__ Detailed documentation requirements were established for the Pascal software required when using interactive microcomputer-based pre-CLASP in a recruiting station. This research described the pre-CLASP and CLASP procedures in depth, the rating

prediction method in use at the MEPS, and the pre-CLASP computer program itself. Therefore, given the appropriate computer hardware at each Navy recruiting station, the pre-CLASP procedure could be implemented throughout the Navy.

Recruiting Management Support

1. The Navy Personnel Accessioning System management support demonstration (working paper) (Giese, 1980). This research was performed to determine the requirements for a management support subsystem. It provided (a) an overview of management support functions, (b) objectives of a management support demonstration, (c) the relation of the management support functions to the objectives, (d) constraints of the NPAS demonstration system, (e) recommended specific management data support functions to include in the demonstration system, and (f) functional descriptions of the demonstration system's major management support subsystems.

2. Automation of the application for enlistment (DD Form 1966). Complete software and documentation were developed, tested, and refined to permit automated production of page 1 of the application for enlistment (DD Form 1966). Page 1 could be completed on a stand-alone microcomputer usable at a Navy recruiting station. User-friendly, menu-driven, interactive software was designed to make the procedure simple and efficient. Data entry for initial preparation was elicited by the system, placed in its appropriate location on the form, and stored for subsequent review, revision, or printing. Redundant data entry was eliminated, resulting in a savings of time and elimination of error correction requirements. A comparison of keystroke requirements for both the manual and automated versions of page 1, DD Form 1966, clearly demonstrated the benefits of automation.

3. Automation of other selected management functions. The initial selection of additional management functions that could be automated was made based on needs assessment studies and suggestions from recruiters. Recruiters and recruiting managers were surveyed about as required report requirements and other enlistment forms and records. Those functions were identified that, when automated, would reduce the clerical burden of the recruiters and increase the ease of supervision by management. Data element requirements for several possible management functions were established. To illustrate the benefits of automation, researchers developed a model zone supervisor's goal/accession report. The report would be useful to the NRD zone supervisors in monitoring their unit's progress and in reporting to higher management. This report could be produced on demand by NPAS at scheduled intervals (e.g., monthly) or on an as required basis.

LISTING BY TYPE OF R&D PRODUCT

<u>Published Reports</u>

Baker, H. G. A person-job matching system for Navy recruiting: Background and needs assessment (NPRDC Tech. Note 83-7). San Diego: Navy Personnel Research and Development Center, May 1983. (a)

Baker, H. G. Navy Personnel Accessioning System (NPAS): I. Background and overview (NPRDC Spec. Rep. 83-34). San Diego: Navy Personnel Research and Development Center, May 1983. (b)

Baker, H. G., Rafacz, B. A., & Sands, W. A. Navy Personnel Accessioning System (NPAS): III. Development of a microcomputer demonstration system (NPRDC Spec. Rep. 83-36). San Diego: Navy Personnel Research and Development Center, May 1983.

Data/Ware Development, Inc. Remote terminal emulation system: Data description and definition list (T-20-2103, Contractor's report prepared for NAVPERSRANDCEN). San Diego: Author, February 1980.

Data/Ware Development, Inc. Remote terminal emulation system: Structured block diagrams (T-20-2104, Contractor's report prepared for NAVPERSRANDCEN). San Diego: Author, February 1980.

Data/Ware Development, Inc. Remote terminal emulation system: Structured design (T-20-2102, Contractor's report prepared for NAVPERSRANDCEN). San Diego: Author, March 1980.

Data/Ware Development, Inc. Remote terminal emulation system: System user's manual (T-10-2077, Contractor's report prepared for NAVPERSRANDCEN). San Diego: Author, March 1980.

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Giese, K. W., & Wyrick, T. F. The Navy Personnel Accessioning System needs assessment for personnel management support (Contractor's report prepared for NAVPERSRAND-CEN). Washington, DC: Federal Computer Performance Evaluation and Simulation Center, April 1981.

Korotkin, A. L., & Marshall-Mies, J. C. The computer as a tool in counseling and testing (Contractor's final report prepared for NAVPERSRANDCEN). Silver Spring, MD: Richard A. Gibboney Associates, Inc., May 1980.

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Journal Articles

Halstead, D. Career guidance for more effective placement. <u>Proceedings of the 21st Annual Conference of the Military Testing Association.</u> San Diego: Navy Personnel Research and Development Center, October 1979.

Sands, W. A. Automated Guidance for Enlisted Navy Applicants (AGENA) system. <u>Proceedings of the 22nd Annual Conference of the Military Testing Association.</u> Toronto: Canadian Forces Personnel Applied Research Unit, October 1980.

Sands, W. A. The Navy Personnel Accessioning System . <u>Proceedings of the 23rd Annual Conference of the Military Testing Association.</u> Arlington, VA: United States Army Institute for the Behavioral and Social Sciences, October 1981.

Presentations at Professional Meetings

Halstead, D. <u>Career guidance for more effective placement.</u> Paper presented at the 21st Annual Conference of the Military Testing Association. San Diego: Navy Personnel Research and Development Center, October 1979.

Halstead, D., & Sands, W. A. <u>The Navy Personnel Accessioning System (NPAS).</u> Paper presented at the meeting of the Canadian Forces Personnel Applied Research Unit, Toronto, May 1980.

Sands, W. A. <u>The Automated Guidance for Enlisted Navy Applicants (AGENA) system.</u> Paper presented at the 22nd Annual Conference of the Military Testing Association, Toronto, October, 1980.

Sands, W. A. <u>The Navy Personnel Accessioning System.</u> Paper presented at the 23rd Annual Conference of the Military Testing Association, Arlington, VA, October 1981.

Unpublished Reports and Working Papers

Betts, G. E. <u>Pre-CLASP documentation</u> (working paper). San Diego: Navy Personnel Research and Development Center, August 1981.

Data/Ware Development, Inc. <u>MIPROC</u> (T-100-2447, Contractor's report prepared for NAVPERSRANDCEN). San Diego: Author, October 1980.

Giese, K. W. <u>The Navy Personnel Accessioning System management support demonstration</u> (Contractor's paper prepared for NAVPERSRANDCEN). Washington, DC: Federal Computer Performance Evaluation and Simulation Center, May 1980.

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Kresin, H., & Giese, K. W. NPAS configuration alternatives: Preliminary results (working paper prepared for NAVPERSRANDCEN). Washington, DC: Federal Computer Performance Evaluation and Simulation Center, July 1981.

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Navy Personnel Accessioning System: Project goals. Presented to the NPAS Steering Committe (including members from NRC, Naval Material Command, Chief of Naval Operations, Bureau of Personnel, and Navy Data Accounting Center), by M. F. Wiskoff, P. R. Foley, B. A. Rafacz, and M. Underwood, at Navy Annex, Washington, DC, 20 September 1978.

Project NPAS: Functions. Presented to Canadian Forces Personnel Applied Research Unit staff, by W. A. Sands and D. Halstead, at Toronto, 28 May 1980.

Functions and planning issues, project NPAS. Presented to L. Smith, OP-16, by P. Foley, at Navy Personnel Research and Development Center, San Diego, 5 July 1980.

NPAS project status, and coordination with NRC. Presented to CDR P. Van Winkle, NRC, by W. A. Sands, at Navy Personnel Research and Development Center, San Diego, 8 July 1980.

Project plan and status report. Presented to NPAS project staff at NAVPERSRANDCEN, by K. W. Giese, Federal Computer Performance Evaluation and Simulation Center at Navy Personnel Research and Development Center, San Diego, 8 July 1980.

Demonstration of RTE hardware equipment. Presented to NAVPERSRANDCEN personnel by B. A. Rafacz, at Navy Personnel Research and Development Center, San Diego, 16 July 1980.

Navy Personnel Accessioning System. Presented to CAPT Zierdt and CAPT Porter, NRC, by P. Foley and W. A. Sands, at Navy Recruiting Command, Washington, DC, 11 September 1980.

Project NPAS. Presented to CAPT Zierdt and CAPT Porter, NRC, by P. Foley and W. A. Sands, at Navy Recruiting Command, Washington, DC, 23 October 1980.

NPAS functions, project status, and relationship to Navy recruiting policy. Presented to NRC and Navy Military Personnel Command representatives, by W. A. Sands, at Navy Recruiting Command, Washington, DC, 24 October 1980.

Purposes and goals of NPAS, and the system's impact on recruiting. Presented to NCCM M. Scott, Zone Supervisor, NRD, San Diego, by W. A. Sands, B. A. Rafacz, H. G. Baker, and J. A. Zouzounis, at Navy Recruiting Station, San Diego, 27 May 1981.

Navy Personnel Accessioning System (NPAS): Briefing and microcomputer demonstration. Presented to NC1 J. Smith, Recruiter in Charge, Navy Recruiting Station, Oceanside, CA: by W. A. Sands, B. A. Rafacz, H. G. Baker, and J. A. Zouzounis, at Navy Recruiting Station, Oceanside, CA, 29 May 1981.

Purposes and goals of NPAS, and the system's impact on recruiting. Presented to NCCM M. Scott, Zone Supervisor, NRD, San Diego, by W. A. Sands and H. G. Baker, at Navy Recruiting Station, San Diego, 30 May 1981.

Navy Personnel Accessioning System. Presented to recruiters, Navy Recruiting Station (NRS), San Diego, by W. A. Sands, B. A. Rafacz, H. G. Baker, J. A. Zouzounis and contractor personnel, at Navy Recruiting Station, San Diego, 9 June 1981.

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Navy Personnel Accessioning System (NPAS): Briefing and microcomputer demonstration. Presented to CO, NRD, San Diego, and zone supervisors and recruiters, by W. A. Sands, B. A. Rafacz, H. G. Baker, and J. A. Zouzounis, at Navy Recruiting District, San Diego, 23 June 1981.

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Navy Personnel Accessioning System (NPAS): Briefing and microcomputer demonstration. Presented to CNO (OP-115) Navy managers and invited guests from federal agencies, by W. A. Sands and B. A. Rafacz, at Navy Annex, Washington, DC, 31 July 1981.

Internal Management Documents

1. Mini-MIP, Z1039PN Navy Personnel Accessioning System , August 1978.

2. Navy decision coordinating paper, the Navy Personnel Accessioning System (NPAS), 3 July 1979 (with revisions).

3. Preliminary project plan/customer agreement between NAVPERSRANDCEN and Federal Computer Performance Evaluation and Simulation Center, 5 June 1979.

4. Project management plan, Navy Personnel Accessioning System (NPAS), 5 June 1979 (with revisions).

5. Research and development management plan for the Navy Personnel Accessioning System, April 1980.

6. Research and development management plan for the Navy Personnel Accessioning System, February 1981.

Other End Products

1. Recruit experience questionnaire (REQ) booklet.
2. Recruit experience questionnaire (REQ) administration manual.
3. Recruit structured interview (RSI).
4. Accumulated data, REQ administration (Great Lakes, IL, Orlando, FL, and Combined; Pilot Test, San Diego, CA).
5. Navy ratings data base (long form).
6. Navy ratings data base (short form).
7. Civilian occupations data base.
8. Person-job matching interactive computer dialogues.
9. Person-job matching flow charts.
10. Management support interactive computer dialogues.
11. Management support flow charts.

12. Demonstration system flow charts for person-job matching and management support.
13. Pre-CLASP algorithms.
14. NPAS field demonstration pre-CLASP functional requirements.
15. Functional requirements, CAST portion of demonstration.
16. Computerized Adaptive Screening Test (CAST) item banks (3) and parameters.
17. CAST item selection algorithm.
18. Flow diagrams of the Navy recruiting process.
19. NPAS demonstration system specifications.
20. NPAS demonstration system functional description.
21. NPAS demonstration task management plan.
22. NPAS demonstration PERT chart.
23. NPAS briefing and microcomputer demonstration to CNRC briefing brochure
24. NPAS project color slide collection for briefings, (with verbatim text and outline with revisions).
25. Complete software for administration of CAST.
26. Complete software for administration of VOICE.
27. Complete software for AGENA system introduction module.
28. Complete software for AGENA career planning module.
29. Complete software for AGENA Armed Services Vocational Aptitude Battery (ASVAB) interpretation module.
30. Complete software for AGENA session/final summary module.
31. Complete software for automated production of page 1 of the application for enlistment (DD Form 1966).
32. Software modification packages for the NPAS demonstration system.

DISTRIBUTION LIST

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